COMPUTER BASED INSTRUMENTATION FOR LEVEL MEASUREMENT USING VISUAL BASIC APPLICATION

MOHD HAFIZ B. HASBULLAH

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Faculty of Electrical & Electronic Engineering
University Malaysia Pahang

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DECLARATION

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Signature : _____

Author : MOHD HAFIZ B. HASBULLAH

Date : 10 NOVEMBER 2008.

DEDICATION

Specially dedicate to

My beloved parents, brothers and sisters.

ACKNOWLEDGEMENT

First, I would like to express my acknowledgment and thanks to my supervisor, Miss Najidah Bt Hambali and not forget to the replacement supervisor Mr Anwar Zawawi for their guidance and co-operation during the project is develop by me

I also deeply thank to my family whose have giving me chance to continue my study at University Malaysia Pahang and full support to complete this project. Thanks for their encouragement, support, love, and their time

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ABSTRACT

Interfaces commonly used to connect computers to instruments system. It is not intended to be definitive, or very detailed, but to give the user an idea of what is readily achievable with the various systems. In this context, the study, research and system development will be focused on using GUI system as a medium to interface with the instrument part. There are several of GUI systems today but Visual Basic application will be use for this project. However, most of computer based instrumentation system widely use in industrial field compared to study field. The purpose of this project is to study the concept of computer based instrumentation system itself, redevelop the system just to make sure it's more efficient and user friendly and to find the answer whether it's suitable to be implement as a learning tools or not. As a result the system developed will be able to interface with the level measurement instrumentation and it can be a very useful learning tool for lab session of subject BEE 4523: Industrial Instrumentation. This system will reduce all the calculation hassle that might be face by the student and will reduce the calculation error because this system provide 100 % calculation made by the computer and the precision of graph should not be hesitate by the user.

ABSTRAK

Pengantaramukakan sering digunakan sebagai penyambung diantara komputer dan sistem peralatan. Ia tidak perlu bertujuan untuk didefinisikan secara mendalam, tetapi hanya memadai untuk memberi idea secara rambang kepada pengguna terhadap apa yang telah dicapai dalam pelbagai sistem yang berbeza. Dalam konteks ini, kajian dan pembinaan sistem lebih difokuskan terhadap penggunaan sistem GUI (Graphical User Interface) sebagai medium untuk mengantaramukakan komputer dengan bahagian peralatan. Terdapat pelbagai jenis sistem GUI dipasaran pada hari ini tetapi aplikasi Visual Basic akan digunakan secara menyeluruh dalam membangunkan projek ini. Bagaimanapun, kebanyakkan penggunaan sistem yang berasaskan komputer dan peralatan lebih digunakan secara meluas dalam bidang pengindustrian berbanding bidang pengajian. Tujuan utama projek ini dibangunkan adalah untuk mengkaji konsep penggunaan sistem berasaskan komputer dan peralatan itu sendiri, membina kembali sistem yang sedia ada untuk memastikan ia lebih efisyen dan mesra pengguna. Serta mencari jawapan, samada aplikasi sistem ini mampu diilhamkan sebagai alat bantu mengajar yang sangat berguna untuk sesi makmal bagi subjek BEE 4523: Industri Instrumentasi. Sistem ini akan mengurangkan segala kerumitan dalam pengiraan yang terdapat dalam sesi lab subjek berkenaan yang mana akan dihadapi sendiri oleh pelajar. Sistem ini juga menawarkan pengurangan peratus kesilapan yang akan dilakukan oleh pelajar kerana sistem ini menyediakan pengiraan 100 % yang akan dilakukan oleh sistem komputer dan kepersisan dan ketepatan graf yang diplot tidak perlu diragui oleh pengguna lagi.

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LIST OF SYMBOL.

USB	-	Universal Serial Bus
DAQ or DAQ	-	Data Acquisition
mA	-	miliampere
m	-	meter
A	-	Ampere
Ω	-	ohm
mV	-	milivolt
I/O	-	input/output
ADC	-	analog-to-digital converter
PC	-	Personal Computer
DAC	-	digital-to-analog converter
RAM	-	Random Access Memory
CPU	-	Central Processing Unit
MHz	-	megahertz
GUI	-	Graphical User Interface
V	-	Volt
IDE	-	Integrated Development Environment
RAD	-	Rapid Application Development
MSDN	-	Microsoft Studio Network
S/H circuit	-	Sample and Hold circuit
MUX	-	Multiplexer
UUT	-	Unit Under Test
MSU	-	Master Standard Unit
	-	Degree of Freedom

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW

"Time best describe as a sharp sword, if you don't try to manipulate it, it can cut you into pieces". These words might be useful as a reminder for every human in this world. Time is priceless and it can't be replaced with anything in this world. As a conclusion, time can be a mute enemy for lecturers in UMP. One semester which consists of six months might be enough for them, but for several reasons such as attending a workshop/seminar, absent because of private reason or on a medical leave, and a lot of public holiday will give an impact on them. As a result, they have to minimize the lab session or ignore it just because to give way to them to cover up a lot of topic before the semester end. This situation should be reconsidered back because through the lab session students might learn more compared to lectures session. They can implement the knowledge that has been taught in class on experiment they had. Besides, learning through experience (project or lab session) is better if compared to

theoretical exercise (homework or notes). For some students who are not so good at the theoretical parts they might be left behind in class.

Some lab session might be difficult if it is done manually, for an example, level instrumentation lab session for BEE4353 contains a lot of calculation that include the mean, standard deviation, uncertainties calculation and students should plotting two graphs. During the lab session, laboratory hand out might be provided by the lecturer, but to understand all those steps and all those equation that contain in it might need a lot of time. Some of the students eager to solve all those problems on their own within the two hours lab, but some of them just becoming a 'parasite' which means, they are not interested to solve the problems but they just want to copy the laboratory results from their friends. The project that will be developed in this project not can make the difficult job become easier but it can also attract and gain interest of these 'parasite' to do their lab session on their own.

Bored with the common system that need user to insert the reading value in text box? Sick of starring at the computer again and again just to confirming the reading entered is right enough? Now everything of it can be replaced with multiple clicking methods only. User just needs three single steps to do this lab session. First, user needs to set up the instrument/apparatus according to the lab sheet provided. Second, user needs to calibrate the reading of DAQ card. Third, user now can start to click the buttons appear in the system. Do not hesitate about it anymore because, every single readings that appears at the Digital Manometer will transferred automatically into the PC, thus this will reduce the typing error occur. If the user follows every single step by referring to the lab sheet, the lab session will end with the desired result. This system is readily to use and it is compatible with the Windows. User does not need to install it into their computer if they want to use it, with just a simple clicking, the system will run automatically and user ready to use it

1.2 PROBLEM STATEMENT

1.2.1 Accuracy of Calculation & Graph

How precise the last result you got compared to the real result provided is depends on how accurate the reading calculation you have made. Previously, calculation made for this kind of laboratory mostly through the manual way (use calculator). Although the calculation made by calculator is correct but the range point of decimal is limited compared to the calculation made by the pc or computers. Some students say, plotting graph might give them a problem. It is all because of; finding the accurate point to plotting graph is hard because the scale of graph paper provided is fixed and cannot be manipulate. Compared to graph plot by the computer, the accuracy of it cannot be argued anymore as long as the point you plot is correct.

1.2.2 User friendly

Manual or traditional style does not provide you a user friendly facility. Fault or error might occur if the user does not understand or not clear about the instruction in the lab sheet given. Especially for several lab session which can described as difficult or complicated.

1.3 PROBLEM SOLUTION

The software that is developed has some advantages to overcome some normal problems that will face by user as state in problem statement.

i. This software provides a wide range of decimal point compared to a regular scientific calculator. Thus, this helps user to get a more accurate and precise result at the end of the lab session

ii. This software has offers a user friendly facility which helps the user to work on the right path even though the user does not understand anything about the instruction in lab sheet provided. Every single step to complete the lab session will be on the right track. Thus the user does not have to worry about it.

1.4 CURRENT SITUATION

Students always complaining they need a lot of time to done this kind of experiment. Although they were aid with the lab sheet given by the lecturer, they have to take time to understand each instruction in the lab sheet. Some of them have an brilliant idea which lead the computer based instrumentation of level measurement created to fulfill their desire. It will help user reduce their time by doing experiment in shorten time

1.5 OBJECTIVE

1.5.1 INSTRUMENT

To understand about the basic measurement principle of level measurement instrumentation and to do more research about the basic measurement principle of level transmitter itself, because there are several type of measurement devices such as differential pressure transmitter that can be used.

1.5.2 HARDWARE

To interface the level measurement instrumentation with software system by using DAQ board. Familiarize with various type of data communication to computer like USB, serial port and parallel port. Each of these have different configuration. This system will use USB as a way to connect to computer in order to receive data from instrument.

1.5.3 SOFTWARE

To develop system using Visual Basic application which easy for user to plotting graph and calculate the uncertainty value. There are several version of visual basic in the market. Some researchers have been made just to make sure what is the best version that should be use to complete this project and get to know more about the real role of visual basic itself.

1.6 SCOPE

The scopes of the project are

i. Study the basic measurement principle of level transmitter.

ii. Searching for the suitable DAQ board model which is can be interface with the visual basic application. Several DAQ board that can be find in market mostly different in model and also can interface with different application

iii. Build up a software that useful for study purpose, make students eager to use the software which will lead them to done their job without any calculation error occurs compare to the all fashion style which is more complicated and takes a lot of time

1.7 THESIS ORGANIZATION

This thesis been made in five chapters which discuss and talk about the overview of the project, objective research, project scope, problem statement and also thesis organization

While in chapter 2, most of this chapter contains of detailed description of literature review based on development of this project. It will explain everything on what previous project that been made by others which is quite same with this project.

In chapter 3, methodology of this project will definitely discuss in this part. It will explain about how the project is being organized and also included about the flow to completing this project. All the circuit design, software design and hardware part will be discussed completely in this chapter.

All the result regarding from this project will be included in chapter4. In this chapter also will contain with the end result and discussion about the project. And finally, the conclusion for this project will be presented in last chapter; chapter5. At this part, recommendation about the future development of this project will be discuss

CHAPTER2

LITERATURE REVIEW

2.1 INTRODUCTION

Computer based instrumentation for level measurement using visual basic application is an automatic system to completing level instrumentation lab session for subject BEE 4523 : Industrial Instrumentation. This system consists of 3 parts which is consists of instrument part, hardware part and software development. Each modules carries own functioning and special features

2.2 Theory of Pressure Measurement

2.2.1 Absolute pressure, gauge pressure, differential pressure and vacuum

Pressure is the force exerted by a gas or liquid on a surface. The SI unit of pressure measurement is the Pascal (Pa). Other common units are N/m , Torr, psi and bar. It is critical to specify the reference point of the pressure.

When we measure a pressure in a system with perfect vacuum or absolute zero as the basis then we call the value of the pressure as the *absolute pressure*. When the pressure is measured with reference to the atmospheric pressure as the basis then the measurement is called the *gauge pressure.* The relationship between absolute pressure and gauge pressure is expressed as

+ 101.3

Where,

And = absolute and gauge pressure respectively, kPa

The 101.3 in the equation is the standard atmospheric pressure at the earth's surface in kPa.

Vacuum gauges are used when the pressure being measured has a value less atmospheric pressure. Vacuum pressure may be expressed as absolute pressure or vacuum units. For example, 10 kPa vacuums signify a pressure of 10 kPa below atmosphere pressure, that is, an absolute pressure of 91.3kPa (101.3kPa – 10kPa).

Differential pressure signifies the difference in pressure between two points. Differential pressure measurement is useful for measuring flow or level.

In the case of flow, a device like orifice or venture tube is introduced into the flow path. This creates a pressure drop between the upstream and downstream points of that orifice that is related to the flow rate. Hence by measuring the pressure difference between the upstream and downstream points of the orifice we can measure the pressure drop and hence calculate the flow rate. [1]

For measuring level in tank the differential pressure between the bottom at the tank and the top of the tank is measured which is directly related to the hydrostatic head created by the liquid level which can be converted to the level using the density of the liquid.

2.2.2 Mechanical Transducers for Pressure Measurement

Pressure is measured by the force it exerts on a mechanical element and the corresponding deflection of the mechanical element. The common types of mechanical devices used are the Bourdon gauge, Bellows and Diaphragm as shown in figure 2.1.

The Bourdon gauge consists of a tube with elliptical cross section bent in the form of the arc of a circle. One end of the tube is fixed and the other is free to rotate. The free end is closed while the fixed end is connected to the pressure to be measured. When a pressure is applied inside the tube the elliptical cross section tends to become more circular. This produces a torque which tries to move the free end in a direction such that the arc becomes straighter. This small movement is converted to an electrical signal by using a suitable technique. [1]

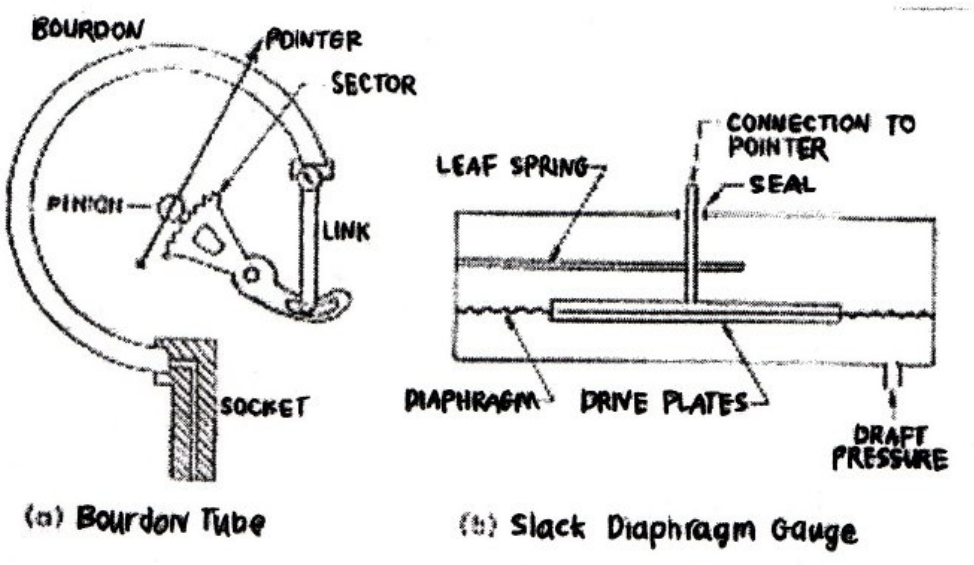

Figure 2.1

In the case of a bellows the pressure is applied to a bellows made of metal like stainless steel or phosphor bronze. One side is fixed and the other side is free to

move. The application of pressure causes a small deflection to the free end which is converted to an electrical signal using a suitable technique.

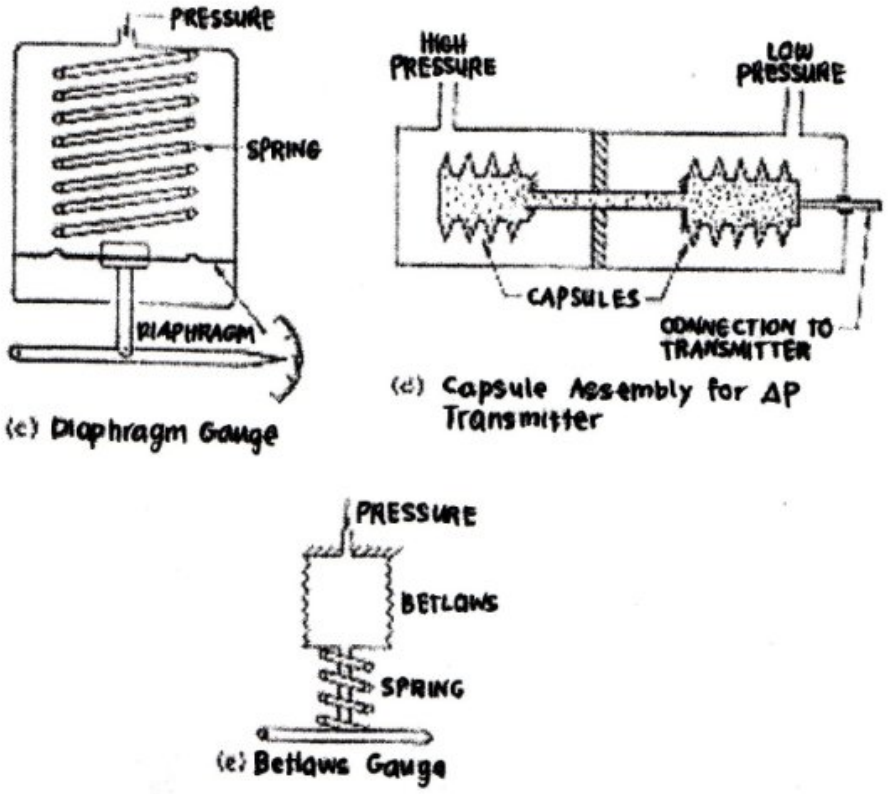

Figure 2.2

The diaphragm transducers are made of thin metallic diaphragms. They are fixed along the periphery and enclosed in a diaphragm box. When we apply the pressure to one side of the diaphragm it causes a deflection in the middle of the diaphragm which is converted to an electrical signal by appropriate methods.